National Aeronautics and Space Administration

NASAfacts

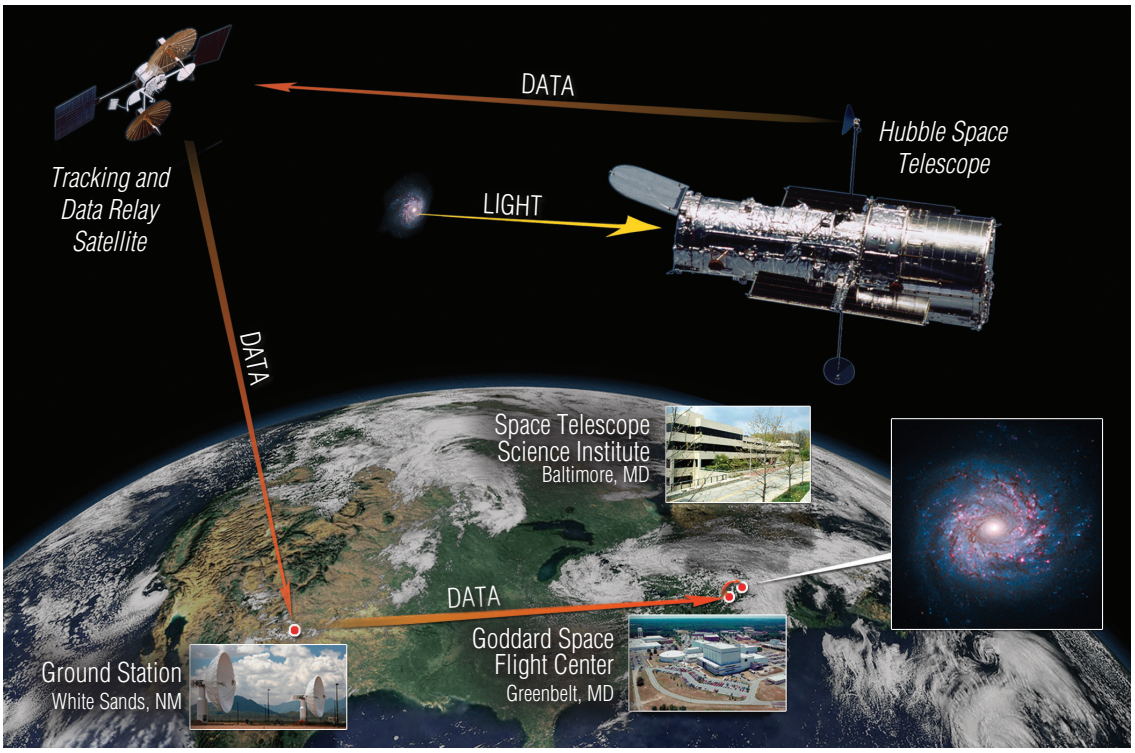
Hubble Space Telescope – Mission Operations

NASA's Goddard Space Flight Center (GSFC) is home to the Hubble Space Telescope Operations Project, the government's team of technical managers and scientists who oversee all aspects of the Hubble mission. Under its direction, an integrated group of civil servants and contractors at GSFC collectively known as the operations team is responsible for Hubble's mission operations—those functions of the mission that operate together to assure the health, safety, and performance of the spacecraft. Examples include monitoring and adjusting the spacecraft's subsystems (e.g., power, thermal, data management, pointing control, science instruments, etc.), flight software development, sustaining engineering of the control center hardware and software, and systems administration of the network and ground system components.

A separate contractor team at the Space Telescope Science Institute (STScI) in Baltimore, Maryland, is similarly responsible for science operations—the functions necessary to award telescope time, schedule observations, create command timelines, calibrate the received data, and archive the datasets. Working closely together, GSFC and the STScI operate Hubble 24 hours a day, 7 days a week, though most of the commanding to the telescope and receipt of its science data is accomplished by computers via automated operations.

The Space Telescope Operations Control Center (STOCC) is located at GSFC. It consists of a Mission Operations Room (MOR) and an Operations Support Room (OSR). The MOR is Hubble's primary command and control room; both manual and automated operations are performed from this location.

Prior to the implementation of automated operations in May 2011, a team of console operators staffed the MOR around the clock. They executed the required procedures to acquire communications with the telescope, manage Hubble's science and engineering data recorders, and load Hubble's computers with command sequences. They also monitored telemetry from the spacecraft and reported any problems or concerns to the appropriate subsystem engineers.



Hubble transmits its data using the TDRSS spacecraft.

The Mission Operations Room during observatory commanding (left) and the Operations Support Room during Servicing Mission 4 (right).

These functions, which form Hubble's daily routine, are now performed autonomously, enabling STOCC personnel to focus on special operations and various tests. Since the advent of automated operations, the STOCC is staffed only eight hours a day, five days a week. If an anomaly occurs on the spacecraft or within the ground system when the facility is unoccupied, a high-reliability text-messaging system immediately alerts the appropriate members of the operations team.

In the Operations Support Room (OSR), STOCC personnel interface with a high-fidelity spacecraft simulator (or the spacecraft) to conduct a variety of tasks. These include testing any configuration changes planned for Hubble, analyzing engineering telemetry, testing flight or ground software updates, and running any contingency procedures or other special commanding in response to an observatory anomaly. The operations team continuously examines spacecraft subsystem performance, looking for trends that could signal component degradation and identifying ways to improve system performance and extend the mission's lifetime.

Communications with Hubble are accomplished via a network interface from the STOCC to NASA's White Sands Test Facility complex located in White Sands, New Mexico, near Las Cruces. The large antennas there transmit radio waves to NASA's Tracking and Data Relay Satellite System (TDRSS), which forwards them to Hubble. Science observations and engineering data that the telescope stores on solid-state recorders are returned to GSFC using the reverse path. Once received and quality checked, the science data is forwarded to the Space Telescope Science Institute via dedicated high-speed network links where it is processed, archived, and distributed.

The Hubble mission and science operations teams strive to set the standard for NASA's great observatories by continuously improving the telescope's science productivity. The optical quality of the telescope, the excellent pointing performance of the spacecraft, the diverse capabilities of its instruments, and the skillful dedication of the mission's staff keep Hubble at the forefront of observational astrophysics.

The observatory is operating at peak performance thanks to the astronauts who successfully completed Servicing Mission 4 in May 2009. In that mission, space-shuttle-based astronauts installed two advanced-technology instruments, repaired two others, replaced a Fine Guidance Sensor, six gyros, six batteries, and the instrument computer, and outfitted certain equipment bays with protective thermal blankets. These upgrades position Hubble to continue its mission of discovery into the next decade.

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